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Title of the Invention: METHOD OF ASSEMBLING MOTOR VEHICLE BODY

### DECLARATION

I, Natsuko Tosa, hereby declare:

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that I am well acquainted with both the Japanese and English  
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【Title of the Invention】 METHOD OF ASSEMBLING MOTOR VEHICLE  
BODY

【Claims】

5   【Claim 1】

A method of assembling a car body by spot welding a bridging  
part to a pair of side members welded to an underbody which  
is positioned at a predetermined portion of a car body assembly  
line, utilizing:

10       a pair of frames installed at sides of a predetermined  
portion of the car body assembly line where the underbody and  
the side members are positioned;

      a plurality of movable joisted jigs attached to the an  
upper predetermined portion of the frame, the joisted jigs  
15   having clamp arms for clamping a plurality of portions of the  
side members and the bridging part; and

      a transfer system for conveying the joisted jig from a  
stock area to the upper predetermined portion of the frame,  
and for conveying the joisted jig from the upper predetermined  
20   portion of the frame to an unloading area;

      wherein the side members and the bridging member are  
clamped by the clamp arms, the side members temporarily welded  
to the bridging part, and in replacing the joisted jigs  
according to change of car types, the transfer system conveys  
25   the joisted jig from the upper predetermined portion of the  
frame to the unloading area and conveys the joisted jig to the  
upper predetermined portion of the frame.

【Claim 2】

The method of assembling a car body according to claim 1, wherein the frame and the joisted jig are located and fixed by a clamp mechanism.

5   【Claim 3】

3. The method of assembling a car body according to claim 1 or 2, wherein the transfer system includes an elevating mechanism, a movable rail moved up and down by the elevating mechanism, a fixed rail to be combined with the movable rail, 10 and a pulley movable along the movable rail and the fixed rail, the joisted jig being hung from the pulley when replacing the joisted jigs.

【Claim 4】

The method of assembling a car body according to claim 3, wherein 15 the transfer system further includes a sway prevention mechanism for preventing the movable rail from swaying when the movable rail and the fixed rail are disconnected.

【Claim 5】

The method of assembling a car body according to claim 3 or 20 4, wherein the movable rail is provided with a fall prevention mechanism for preventing the pulley from falling out of the movable rail when the movable rail and the fixed rail are disconnected.

【Detailed Description of the Invention】

25   【0001】

【Field of the Invention】

The present invention relates to a method of assembling a motor

vehicle body. Specifically, the present invention relates to a method for pre-fixing bridging parts, such as a roof panel, a header inner and a frame back, to the left and right side members, which are welded to an underbody.

5    【0002】

      【Prior Art】

A car body includes main parts such as an underbody, left and right side members, and a roof panel. The main parts are positioned relative to each other using locating jigs, etc.

10   In the positioned manner, the parts are fixed by spot welding, thereafter re-spot welded.

      【0003】

A conventional method of assembling a car body generally utilizes a large locating jig for locating the main parts. For example, a jig used to position the roof panel is screen-like and a size larger than the roof panel itself. Such locating jig is installed above the car body assembly line and is movable up and down. Then the roof panel is transferred to a position below the locating jig, and set into the locating jig. Next, the locating jig is lowered to position both sides of the roof panel on the upper ends of the side members. Finally, in this manner, the roof panel is spot welded to the side member.

      【0004】

No patent or nonpatent document is cited.

25   【0005】

      【Problems to be Solved】

The above-described screen-like locating jig is large and heavy,

thus tends to require large facility investment at the beginning. Further, a lot of effort is required for removing the locating jig from a moving mechanism of the locating jig and replacing the locating jig with another one, corresponding  
5 to change (replacement) of types of manufactured cars, and the production line may be completely stopped during the replacement.

**【0006】**

The jig for the roof panel and for the side members are  
10 independent to each other. The roof panel is pre-fixed relative to the side members precisely, so that the sides of the three jigs facing to the car body are precisely positioned relative to the stationary floor. The jigs for roof panel and for the side members are attached to a transfer system movable  
15 up and down or back and forth. The location accuracy of the transfer system exactly determines the location accuracy of the roof panel relative to the side members. As the transfer system must move large and heavy jigs up and down or back and forth at significantly high speed, advanced technique and  
20 constant maintenance are required to maintain exact location accuracy. Still, in fact, the location accuracy may be gradually lowered due to wear at a movable portion of the transfer system.

**【0007】**

25 The lowered location accuracy of the roof panel and the side members may cause deformation at front and rear window openings, and a slight error may affect fitting of window shield. In



locating the roof panel utilizing the conventional large jigs, both of the side members cannot be evenly attached to welding ends of the roof panel at the same time, but either of the side members first contacts the welding end. With such an arrangement, the uneven contacting manner of the side members relative to the roof panel may cause a slight error in the location accuracy.

**【0008】**

Further, highly accurate robot for transferring and locating the roof panel raises the business investment at the beginning for its complexity and expensiveness, while requiring skilled and troublesome maintenance for maintaining its high accuracy.

**【0009】**

Thus, an object of the present invention is to reduce weight and size of the jigs for the roof panel, thereby reducing the business investment at the beginning and facilitating and speeding up the replacement of the jigs. Further, the object includes to provide a car body assembly method for exactly locating and pre-fixing bridging part, such as the roof panel, the header inner and the frame back to the side members without utilizing large transfer system for moving the jigs nor expensive robot.

**【0010】**

**【Means for Solving the Problems】**

According to the present invention, a method of assembling a car body by spot welding a bridging part to a pair of side members welded to an underbody which is positioned at a predetermined

portion of a car body assembly line utilizes: a pair of frames installed at sides of a predetermined portion of the car body assembly line where the underbody and the side members are positioned; a plurality of movable joisted jigs attached to  
5 the an upper predetermined portion of the frame, the joisted jigs having clamp arms for clamping a plurality of portions of the side members and the bridging part; and a transfer system for conveying the joisted jig from a stock area to the upper predetermined portion of the frame, and for conveying the  
10 joisted jig from the upper predetermined portion of the frame to an unloading area; wherein the side members and the bridging member are clamped by the clamp arms, the side members temporarily welded to the bridging part, and in replacing the joisted jigs according to change of car types, the transfer  
15 system conveys the joisted jig from the upper predetermined portion of the frame to the unloading area and conveys the joisted jig to the upper predetermined portion of the frame.  
(claim 1)

**【0011】**

20 Preferably, the frame and the joisted jig are located and fixed by a clamp mechanism. (claim 2)

**【0012】**

Preferably, the transfer system includes an elevating mechanism, a movable rail moved up and down by the elevating  
25 mechanism, a fixed rail to be combined with the movable rail, and a pulley movable along the movable rail and the fixed rail, the joisted jig being hung from the pulley when replacing the

joisted jigs. (claim 3)

【0013】

Preferably, the transfer system further includes a sway prevention mechanism for preventing the movable rail from  
5 swaying when the movable rail and the fixed rail are disconnected. (claim 4)

【0014】

Preferably, the movable rail is provided with a fall prevention mechanism for preventing the pulley from falling out of the  
10 movable rail when the movable rail and the fixed rail are disconnected. (claim 5).

【0015】 When the bridging part such as the roof panel, the header inner and the frame back are temporarily placed between the upper ends of the side members and then connected to the side  
15 members by the joisted jigs, the bridging members and the welding ends of the side members are fixed to the stationary system via the frames. Thus, the upper and lower welding ends of the side members are all positioned relative to the stationary system, while the welding ends at the four corners  
20 or at four portions at the sides of the bridging part are all positioned relative to the floor. As a result, the side members and the bridging part are pre-fixed in the positioned manner, without generating deformation at the front and rear window openings, thereby forming desired front and rear window  
25 openings.

【0016】

The joisted jigs are lighter and smaller than the conventional

jigs for the roof panel, thereby largely reducing the business investment at the beginning. Further, the stock area of joisted jigs for replacement and the transfer system for the jigs are provided at the side of the roof temporary welding station, thereby enabling quick replacement of the jigs without using a transfer line for the jigs.

【0017】

The joisted jigs are located relative to the frame by the clamping mechanism, which locates and fixes the joisted jigs at predetermined portions of the frame with high accuracy, thereby pre-fixing the bridging members at predetermined portions of the side members with high accuracy.

【0018】

The transfer system includes an elevating mechanism such as a hoist or an air cylinder, a movable rail moved up and down by the elevating mechanism, fixed rails to be combined with the movable rail, and a pulley movable between the fixed rails, while the joisted jig is hung from the pulley when replacing the joisted jigs, thereby enabling replacement of the joisted jigs without utilizing a complicated and expensive robot which requires advanced technique for its maintenance.

【0019】

The elevating mechanism further includes a sway prevention mechanism for preventing the movable rail from swaying when the movable rail and the fixed rail are disconnected. Due to the structure preventing the movable rail from swaying in replacement of the joisted jigs, the joisted jigs hung from

the movable rail are prevented from bumping into the frames and being damaged or deformed, and can be positioned at predetermined portions of the frame in a short time.

【0020】

5 The movable rail is provided with a fall prevention mechanism for preventing the pulley from falling out of the movable rail when the movable rail and the fixed rail are disconnected. Due to the structure, the joisted jigs hung from the pulley are prevented from falling out of the movable rail, thereby  
10 preventing the bridging members and the joisted jigs from being damaged or deformed.

【0021】

【Mode for Carrying out the Invention】

Preferred embodiments of the present invention is specifically  
15 described below with reference to the accompanying drawings. Fig. 1 is a schematic view illustrating a side member temporary welding station 1. The side member temporary welding station 1 is arranged at a predetermined position in a car body assembly line 2, as shown in Fig. 2. The car body assembly line 2  
20 includes an underbody placing station arranged upstream of the side member temporary welding station 1. An underbody 3 placed in this underbody placing station as shown in Fig. 3 includes a rear portion (the right side in Fig. 3) which faces downstream of the car body assembly line 2 while being carried by a coaster  
25 moving along a transfer path such as a roller conveyor 11. The under body is sent to an underbody setting station 5 (#0) and to the side member temporary welding station 1 (#1).

【0022】

As shown in Fig. 2, the downstream side of the side member temporary welding station 1 (#1) is provided with a roof pre-setting station 6 (#2) where a roof panel is temporarily placed on a side member 4 whose lower welding end is finally welded, and a roof temporary welding station 7 (#3) in this order. A roof final welding station 8 (#4) is provided downstream of the roof temporary welding station 7 (#3). When many portions of the roof panel is to be permanently welded, as shown, the roof final welding station 8 may be divided to a plurality of roof final welding stations 8-1 (#4)-8-3 (#6) so that workload for final welding per one worker is not increased too much. The downstream side of the roof final welding station is provided with a final welding station 9 (#7) having a welding robot for locating and final welding, and also provided with an unloading station 10 (#8).

【0023】

In the car body assembly line 2, the underbody 3 and so on are carried between the stations by the roller conveyor 11 shown in Fig. 4(A) and coasters 13a, 13b moving along the roller conveyor 11 as described below. The roller conveyor 11 includes a plurality of rotatable rollers 11a, whose longitudinal direction is perpendicular to the transfer direction of the under body 3 and so on, each spaced to each other at a predetermined distance in the transfer direction of the underbody 3 and so on.

【0024】

In the side member temporary welding station 1 (#1) and the roof pre-setting station 6 (#3), for adjusting the height of the underbody 3 corresponding types of cars, as shown in Fig. 4(B), the conveyor 11 is lifted by an elevating mechanism such as a pantograph mechanism 14, for example. The pantograph mechanism 14 includes a plurality of supporting members 14a pivotably connected by a pin 14 and an air cylinder 14c reciprocally moving the lower end of one of the supporting members 14a via a sliding mechanism 14d..

10    【0025】

As shown in Fig. 5, the coasters 13a, 13b on which the underbody 3 is placed to be carried along the roller conveyor 11 include a base 131 having a width shorter than the length of the rollers 11a and a length long enough to cover at least two rollers 11a. One widthwise end of the base 131 is provided with a L-shaped angle bar 132 fixed by a bolt for preventing widthwise movement during transfer. The upper surface of the base 131 is provided with a plurality of vertical supporting members 133 for supporting the underbody 3 at a proper height.

20    【0026】

As shown in Fig. 4(A), the coasters 13a, 13b are arranged to support the underbody 3 at four or more portions, at least two portions at each of the front and rear portions. A worker pushes the underbody 3 by hand to transfer the underbody 3 on the roller conveyor 11.

      【0027】

As shown in Figs. 6(A), 6(B), the side member temporary welding

station 1 is provided with four sets of lifters 15, two sets at each of front and rear portions of sides of the car assembly line 2, perpendicularly to the car body assembly line 2. Each lifter 15 is provided with a plurality of locators 16 for  
5 locating the side member 4. As shown in Fig. 7, in the side member temporary welding station 1, the side members 4, 4 are positioned by the locators 16 and their lower ends are pre-fixed to the underbody 3.

**【0028】**

10 Specifically, the side member temporary welding station 1 is provided with a lifter 15 arranged symmetrically at the sides of the car body assembly line 2 and perpendicularly to the car body assembly line 2. Below each lifter 15, a slide guide 17 (see Fig. 1) extending in parallel to the lifter 15 is provided.  
15 The rear side of the slide guide 17 is provided with a slide base 18 which is reciprocally moved along the slide guide 17 by the worker. The locator 16 placed on the lifter 15 above the slide base 18 is moved downward and transferred to the slide base 18 to be positioned thereon. Thereafter, the slide base  
20 18 is moved along the slide guide 17 to move the locator 16 toward and away from the car body assembly line 2.

**【0029】**

Each locator 16 includes a bottom surface which is provided with four wheels 20 rotatable on the floor and also provided  
25 with spacers 21 and a plurality of holes 22 into which locating pins 25 of the slide base 18 are inserted. With such an arrangement, the locators 16 are moved toward (forward) and



away from (backward) the car body assembly line 2 as the worker pushes and pulls the slide base 18. As shown in Fig. 8, the lifter 15 includes a rear end provided with guards 19 for preventing the wheels 20 from falling, and with a locating member 23 with which the wheel 20 contacts for locating the locator 16 provisionally.

【0030】

As shown in Fig. 6(B), the slide base 18 engaged and moved with the locators 16 includes a top surface provided with spacers 24 which contact with the spacers 21, in addition to the locating pins 25 inserted in the holes 22 of the locators 16. The lifter 15 can be lifted up to a position X in Fig. 6(B) at which the top surface of the lifter 15 is flush with the floor level. On the other hand, the lifter 15 can be lowered down to a position Y. In the lowering process to the position Y, the locating pin 25 of the slide base 18 is inserted into the hole 22 of the locator 16, so that the locator 16 is positioned on the slide base 18 and engaged therewith.

【0031】

As shown in Fig. 9, the slide base 18 may include a base 18a which is provided with vertical locating pins 25 for locating a plurality of locators 16, and may be provided with a handle 18b which is pushed or pulled by the worker. As shown in Figs. 10A and 10B, each locator 16 may also be supported by a respective slide base 18. This structure is preferable that the worker can get in between two locators 16 to perform temporary welding.

【0032】

In the above structure where each locator 16 is supported by a respective slide base 18, a plurality of slide bases 18 are connected to each other via a removable connecting rod 26. 5 Preferably, the worker pushes or pulls the connecting rod 26 to move the slide bases 18 together forwardly and backwardly. The connecting rod 26 may be linear as a whole, but desirably, is a crank having a bending portion 26a between the locators 16, as shown. With such crank-like connecting rod 26, when 10 the bending portion 26a is positioned downward as shown, the connecting rod 26 does not obstruct the operation at the upper portion of the side member 4. When the bending portion 26 is positioned upward as indicated by chain double-dashed lines 26a', the connecting rod 26 does not obstruct the operation 15 at the lower portion of the side member 4.

【0033】

As shown in Fig. 10B, the slide base 18 may be provided with a angle 27 at the front part, and the angle 27 may contact with a stopper 28 for defining the forward movement of the slide 20 base 18. The stopper 28 includes a jaw 30 which is operated by an air cylinder 29 to clamp the angle 27, thereby firmly holding the slide base 18 at a determined position.

【0034】

For example, the lifter 15 arranged above and parallel to the 25 slide guide 17 is moved up and down between the upper position indicated by solid lines in Fig. 11 and the lower position indicated by chain double-dashed lines, using a pantograph

mechanism similar to the one shown in Fig. 4(B). When the lifter 15 is lifted to the upper position indicated by solid lines, its top surface is flush with the floor level. In this state, the locator 16 provided with the wheels 20 can be easily  
5 pushed by the worker to be moved on the floor, and be transferred to the rear end of the lifter 15. Thereafter, the wheel 20 contacts with the locating member 23 to provisionally position the locator 16 on the lifter 15, while the slide base 18 is moved backward to the rear end of the slide guide 17. In this  
10 state, the lifter 15 is lowered, and during the lowering process, the locating pin 25 of the slide base 18 is fitted into the hole 25 of the locator 16, whereby the locator 16 is engaged with and positioned on the slide base 18. When the lifter 15 is further lowered, the wheel 20 of the locator 16 is detached  
15 from the lifter 15, and the locator 16 is finally positioned on the slide base 18.

【0035】

Next, the locator 16 transferred and positioned on the slide base 18 holds the side member 4, and the slide base 18 advances  
20 along the slide guide 17 toward the car body assembly line 2, whereby the side member 4 is moved toward the car body assembly line 2 to be positioned at the side of the underbody 3 which is on standby. In this state, the lower welding end of the side member 4 is pre-fixed to the positioned underbody 3 by  
25 the worker. If each locator 16 is supported by a respective slide base 18 as described above, the temporary welding operation can be facilitated by enabling the worker to work

between the front and rear slide bases 18, 18, by moving the bending portion 26a of the connecting rod 26 between the lower part and the upper part (26a'), or by removing the connecting rod 26.

5     **【0036】**

A plurality of locators 16 are stocked for replacement in the vicinity of the car body assembly line 2. As indicated by reference number 1 in Fig. 12, one of the locators 16 is moved by the worker utilizing the wheels 20 on the floor, and is  
10 transferred to the lifter 15 at the upper position flush with the floor level. When the lifter 15 is lowered as indicated by reference number 2, the locator 16 placed on the lifter 15 is transferred and positioned on the slide base 18 which is on standby at the rear end of the slide guide 17 (see Fig. 1).  
15 As indicated by reference number 3, the slide base 18 supporting the locator 16 is moved by the worker and advances along the slide guide 17 to the position indicated by solid lines, where the side member 4 is positioned by the locator 16. Next, the slide base 18 is pushed by the worker to advance along the slide  
20 guide 17 to the position indicated by chain double-dashed lines. In this state, the underbody 3 which is transferred to the side member temporary welding station 1 to be on standby and the side member 4 which is transferred to the underbody 3 by the locator 16 are positioned to each other at the bottom welding  
25 ends contacting at two sets of front and rear portions, four portions in total. After the positioned underbody 3 and the side member 4 are pre-fixed at the bottom welding ends, the

locator 16 is released, and as indicated by reference number 4, is retreated with the slide base 18 from the chained line position to the solid line position in Fig. 12. Thereafter, next side member 4 is positioned and supported at the locator 5 16 to be on standby for next temporary welding of the underbody 3 and the side member 4.

【0037】

The same procedure as described above is repeated, when the next underbody 3 transferred to the side member temporary 10 welding station 1(#1) is of the same type as the previous underbody 3. Specifically, the underbody 3 advances from the solid line position to the chain double-dashed line position in Fig. 12, and pre-fixed to the side member 4. Next, the locator 16 is retreated to the solid line position and holds 15 next side member 4 which is positioned to be on standby for next temporary welding of the underbody 3 and the side member 4.

【0038】

The procedure of the replacement of car types is described below. 20 When an underbody 3 of a type different from the previous underbody 3 is transferred to the side member temporary welding station 1, the previous locator 16 needs to be change, or replaced with a locator 16 of another type. In the replacement, the slide base 18 and the previous locator 16 are positioned 25 at the standby position indicated by the solid lines in Fig. 12, then as indicated by reference number 5, the lifter 15 is lifted to the upper position flush with the floor level.

During this process, the wheel 20 of the locator 16 rides on the lifter 15, and when the lifter 15 is further lifted, the locator 16 is detached from the slide base 18 and transferred to the lifter 15. After the lifter 15 is lifted up to be flush  
5 with the floor level, the worker moves the locator 16 utilizing the wheel 20 from the lifter 15 to the floor. Thereafter, the locator is moved on the floor to be back to a predetermined position at a locator stock area near the car body assembly line 2. On the other hand, as indicated by reference number  
10 6, the slide base 18 is retreated to the rear end of the slide guide, while another locator 16 is moved by the worker utilizing the wheel 20 and placed on the rear end of the lifter 15 at the upper limit .

#### 【0039】

15 As described above, while the previous locator is removed for replacement, the slide base 18 is retreated to the rear end of the slide guide 17 and the next locator 16 is placed on the lifter 15 to be on standby. Thus, after the lifter 15 is lowered to transfer the locator 16 to the slide base 18, necessary  
20 process to position the car of another type is only to advance the slide base 18. As a result, the takt time can be reduced.

#### 【0040】

The locators 16 used in the above procedure are more compact than conventional one. Therefore, locators 16 for replacement  
25 can be prepared near the car body assembly line 2. In the replacement, the worker can manually push and transfer the locator 16 to the lifter 15 easily, utilizing the wheel 20.

Differently, conventional large jig has difficulty in having a space to be prepared near the car body assembly line 2, and is typically stored at a place apart from the car body assembly line 2, and transferred to the side member temporary welding station 1, using a special transfer line. According to the present invention, the compact locator 16 having wheels 20 makes such transfer line for jig unnecessary.

【0041】

As described above, the side member 4 positioned to be held at a predetermined position of the locator 16 is transferred and set at a predetermined position of the underbody 3 which is transferred to be on standby at the side member temporary welding station 1, as shown in Fig. 2. In this way, the bottom welding ends of the set side members 4 can be precisely positioned relative to the side welding ends of the underbody 3, thereby performing temporary welding with high accuracy.

【0042】

The underbody 3 and the side member 4 temporarily welded to each other are transferred to the next roof pre-setting station 6 (#2) in car body assembly line 2. The roof pre-setting station is described referring to Fig. 13. At the roof pre-setting station 6, a roof panel 31 is temporarily placed to bridge the top portion of the side members 4 pre-fixed to the sides of the underbody 3. Further at the roof pre-setting station 6, the underbody 3 and the side members 4 are permanently welded. The roof panel 31 is transferred and placed on the side members 4 by the worker manually or using a manual or

automatic hoist. Thereafter, the bottom welding ends of the side members 4 are permanently welded by two welding machines at each side, four machines in total, for example.

【0043】

5 The temporary welding station 7 (#3) is described referring to Figs. 14-21. In the temporary welding station 7, the roof panel 31 temporarily placed on the side members 4 at the roof pre-setting station 6 (#2) is now positioned and pre-fixed to the side members 4. The roof temporary welding station is  
10 provided with a pair of frames 34 arranged at the sides of the car body assembly line 2, a pair of joisted jigs 35, 36 removably provided to bridge between the upsides of the frames 34, a hoist for transferring the jigs 35, 36, and a spot welding machine (not shown) for temporarily fixing the roof panel 31 to the  
15 side member 4.

【0044】

The present invention can be also applied to fix a bridging member such as a header board or frame back for bridging between the side members 4, instead of fixing the roof panel 31.  
20 Specifically, the header board or frame back may be attached at the bottom surface of the roof panel 31 in advance, or may be attached to the front and rear portions between the side members 4 before the roof panel 31 is fixed to the side members 4, and the present invention can be applied in the latter case.

25 【0045】

As shown in Figs. 14 and 15, the frame 34 includes a portal member having a top surface provided with a clamp mechanism



for removably attaching the end of the joisted jigs 35, 36 at predetermined front and rear portions.

【0046】

As shown in Fig. 16, each of the joisted jigs 35, 36 includes,  
5 in the vicinity of the ends, a bottom side provided with a pair of clamp arms 39. The clamp arms 39 include movable claws manually operated or driven by an air cylinder, for connecting upper welding ends of the side member 4 to side welding ends of the roof panel 31 at front and rear portions.

10 【0047】

In the previous processes, the side member 4 is pre-fixed and then permanently welded to the underbody 3 to be one member, while the coasters 13a, 13b locating and supporting the underbody 3 are placed on a stationary system including the  
15 floor. In this state, the roof panel 31 temporarily placed to bridge the upper ends of the side members 4 is connected to the side member 4 by the joisted jigs 35, 36, and the four welding portions of the roof panel 31 and the side members 4 are positioned on the stationary system via the frame 34. In  
20 this way, four portions of each side member 4, eight portions in total, at upper, lower, front and rear welding ends are all positioned on the stationary system, and four welding ends at the corners of the roof panel 31 are also positioned on the floor. As the roof panel 31 and the side members 4 are pre-fixed  
25 in this positioned state, a front window opening 40 and a rear window opening 41 are not distorted and can be formed as desired front window opening 40 and rear window opening 41.

【0048】

In the conventional assembling method of the side member 4 and the roof panel 31, as described above, the side members 4 may slightly distorted at the two steps for transferring the side  
5 members 4 to the underbody 3, and due to thus distortion, clamping position of the roof panel 31 may be slightly deviated. Further, when the roof panel 31 is clamped at the lower surface of the large jig to be lowered and positioned at the upper end of the side member 4, a sophisticated mechanism and advanced  
10 maintenance skill are required for precise control with high dimensional accuracy of moving such large and heavy jigs up and down. Finally, trial products of the front window opening 40 and the rear window opening 41 are checked to be fitted with window shields. When checking and adjusting each jig for  
15 correcting a bad fit, it is difficult to find out which locating of the underbody 3, side members 4, and roof panel 31 causes the bad fit, even utilizing a precision device.

【0049】

On the other hand, in the present embodiment, the side member  
20 4 is transferred only once and thus unlikely to be distorted. Further, as the four corners of the roof panel 31 and the upper welding ends of the side members 4 at the front and rear portions are clamped at or connected to the stationary system, the front and rear window openings 40, 41 are very highly reliable in  
25 their form and dimension. Especially, as the roof panel 31 is upwardly convex and may elastically expand and contract, only the upper welding ends of the side members 4 at the front

and rear portions are needed to be precisely positioned relative to the stationary floor via the joisted jigs 35, 36 and the frame 34. In this way, the front and rear window openings 40, 41 are never affected even the pressed roof panel 31 has some distortion or warpage at the portions other than the ends of the openings 40, 41. As a result, even a bad fit is caused at the window shield, it is much easier than the conventional art to find out the cause and correct the position.

【0050】

As the clamp arms 39 provided at joisted jigs 35, 36 vary with the car type, individual clamp arm 39 is necessary for respective car type. In the illustrated example, the entire joisted jigs 35, 36 including the clamp arm 39 vary with the car type, and a plurality of types of joisted jigs 35, 36 are prepared near the car body assembly line 2. As the joisted jigs 35, 36 are attached on a higher position of the frame 34, as shown in Figs. 16 and 17, the joisted jigs 35, 36 are desirably stored at mounts 42-1, 42-2. The mounts 42-1, 42-2 have height almost the same as the frame 34 and provided adjacent to the car body assembly line 2.

【0051】

The joisted jigs 35, 36 may be stored at one of the mounts 42-1, 42-2. For increasing the number of replacement or for reducing takt time of the replacement, the mount 42-2 may be provided at the other side, in other words, both of the mounts 42-1, 42-2 may be provided at the same time. With such an arrangement, the mount 42-1 serves as a stock area for loading, and the other

mount 42-2 serves as a stock area for unloading, or both of the mounts may serve as the stock areas for loading. The replacement is basically performed by the worker for both of attaching and removing of the joisted jigs 35, 36, though for  
5 reducing the takt time of the replacement, a transfer means may be provided at the other mount 42-4 to attach and remove the joisted jigs 35, 36.

【0052】

The joisted jigs 35, 36 are spaced to each other longitudinally  
10 of the roof panel 31, thereby providing a wide working space, between the joisted jigs 35, 36, which enables access to the welding ends between the side members 4 and the roof panel 31 while facing the side member 4. Therefore, the temporary welding of the roof panel 31 and the side members 4 can be  
15 performed by a relatively short reach, thereby minimizing the welding machine and simplifying the jigs. Further, due to the facilitated access between the roof panel 31 and the side members 4, another welding machine for final welding can be provided in addition to the welding machine for temporary  
20 welding. As a result, increase of steps performed at one station reduces the number of the entire stations of the car body assembly line 2, thereby shortening the car body assembly line 2.

【0053】

25 When comparing the joisted jigs 35, 36 to conventional jigs for the roof panel, as the jigs for the side members 4, the conventional jigs for the roof panel are a size larger than

the roof panel 31, thereby requiring large business investment and much time for replacing the jigs. Contrary, the jigs according to the present invention are elongated and thus don't take much space. Thus, various joisted jigs 35, 36 may be  
5 stored in a small space near the car body assembly line 2 by providing a suitable shelf. In this way, replacement time can be shortened and transfer system for the jigs can be omitted.

【0054】

Fig. 18(A) shows a transfer hoist 50 as an example of a transfer  
10 system for replacing the joisted jigs 35, 36. As shown, the reference number 51 indicates a ceiling rail. The ceiling rail 51 is provided with a hoist 52, which is an example of the elevating mechanism hung therefrom and moves a movable rail 53 up and down (see Fig. 18B). A fixed rail 54 is provided  
15 below the ceiling rail 51, and partly formed with a space 55 in which the movable rail 54 is inserted. The upper end of the space 55 is provided with a stopper 56 for defining the upper limit of the movable rail 53. The jig 35 (36) is hung by a plurality of pulleys 57. The pulley 57 is rotatably  
20 movable along the movable rail 53 and fixed rail 54.

【0055】

The joisted jig 35 (36) corresponding to types of manufacture cars are transferred by the pulleys 57 along the fixed rail 54 to the movable rail 53, or to the replacing portion above  
25 the roof panel 31. Thereafter, as shown in Fig. 18(B), the movable rail 53 is lowered by the hoist 52, and the joisted jigs 35, 36 are positioned on the frames 34, 34 at the both

sides.

【0056】

A rail swaying prevention mechanism 60 as shown in Figs. 19(A), 19(B) is preferably provided, as the joisted jigs 35, 36 cannot  
5 be bridged at the determined position if the movable rail 53 sways while lowering the joisted jig 35, 36. The illustrated mechanism 60 includes a fixed guide 61 provided at the ceiling downwardly, an upright member 62 extending from the movable rail 53, and a roller 63 rotatably along the guide 61 for  
10 preventing the movable rail 53 from swaying.

【0057】

As shown in Fig. 18(B), when the movable rail 53 is lowered away from the fixed rail 54, the pulleys 57 may fall out of the movable rail 53. To prevent the falling, safety mechanisms  
15 58 for the pulley, or stoppers 58 as shown in Figs. 20A may be provided at the ends of the movable rail 53 for preventing the pulley 57 from moving along the movable rail 53 using a spring (not shown). As shown in Fig. 20B, when the movable rail 53 is inserted in the space 55 of the fixed rail 54, one  
20 end of the stopper 58 is pushed down by the stopper 56 due to the biasing force of the spring. In this way, the stopper is brought into a horizontal posture, whereby the pulley 57 can move from the movable rail 53 to the fixed rail 54 or from the fixed rail 54 to the movable rail 53.

25 【0058】

After being bridged at the determined position at the frames 34, the joisted jigs 35, 36 are fixed to the frame 34 by a

locating mechanism 70 shown in Fig. 21. In the illustrated example, the top surface of the frame 34 is formed with a locating pin 71, while the joisted jigs 35, 36 are formed with a hole 72 in which the locating pin 71 is inserted. After the  
5 locating pin 71 is inserted in the hole 72, a clamp arm 73 is used to fix the joisted jigs 35, 36 to the frame 34.

【0059】

Figs. 22(A) is a front view illustrating a replaceable locating mechanism 80. The mechanism 80 includes an upper part 81 and  
10 a lower part 82 arranged vertically, and the lower part 82 is fixed to the floor while the upper part 81 is rotatably connected to the lower part 82 via a pin 83. The upper part 81 and the lower part 82 are connected to a drive rod of the air cylinder 84. The upper part 81 can be switched into a vertical posture  
15 illustrated by solid lines or into an inclined posture illustrated by broken lines by moving the drive rod out from and into the air cylinder body. Reference numbers 85 and 86 indicate spacers and locating pin, respectively.

【0060】

20 As described above, the upper part 81 which can be inclined prevents the interference between the supporting member 133a and the upper portion 81 of the locating mechanism 80. As illustrated by chain double-dashed lines, suppose that a coaster 13c includes a supporting member 133a which largely  
25 extends in lateral direction beyond the roller conveyor 11 (see Fig. 1). In this case, when the coaster 13c moves on the roller conveyor 11 toward or away from the figure, the upper portion

81 of the locating mechanism 80 is inclined by the air cylinder 84 as shown by the chain lines, thereby being moved away from the transfer path of the supporting member 133a of the coaster 13c and not obstructing the transfer of the coaster 13c. When  
5 using a fixed locating mechanism, as shown in Fig. 22(B), a space S is provided for another locating mechanism in addition to the mechanism 80.

【0061】

The present invention being thus described, it is obvious that  
10 the present invention is not limited to the above embodiment but the same may be modified in various ways. For example, though the worker transfers the side member 4 by hand in the above embodiment, the worker may use a roller conveyor. As shown in Fig. 6(A), more than three locators 16 may be provided  
15 at one side of the car body assembly line 2, corresponding to a long car body. When more than three locators 16 are provided, more than three sets of slide guides 17 and slide bases 18 are also provided at one side. The frames 34, 34 without a connecting portion facilitate the temporary placing of the roof  
20 panel 31 to the determined position on the side members 4, 4 or the temporary welding, as the space between the frames 34, 34 can be utilized. However, when the frames 34, 34 are required to be strengthened, the frames 34, 34 may be provided with a connecting portion.

25 【0062】

【Effect of the Invention】 As described above, when the roof panel temporarily placed between the upper ends of the side



members is connected to the side members by the clamp arms of the joisted jigs, the connected portions are fixed to the stationary floor. Thus, the upper and lower welding ends of the side members are all positioned relative to the stationary system, while the welding ends at the four corners of the bridging part are all positioned relative to the floor. As a result, the side members and the roof panel are pre-fixed in the positioned manner, without generating deformation at the front and rear window openings, thereby forming desired front and rear window openings.

**【0063】**

The joisted jigs are lighter and smaller than the conventional jigs for the roof panel, thereby reducing the business investment at the beginning and speeding up the replacement operation. The replacement of the joisted jigs are performed by a simple and inexpensive transfer system as a transfer hoist, without utilizing a complicated and expensive robot. Thus, a large transfer system for moving the conventional jigs is unnecessary, thereby further largely reducing the business investment at the beginning.

**【0064】** As the joisted jigs are located relative to the frame by the clamping mechanism, the bridging members such as the roof panel are located relative to the side members with high accuracy. As the sway prevention mechanism prevents the movable rail from swaying, the joisted jigs can be positioned at predetermined portions of the frame in a short time. Further, as the fall prevention mechanism prevents the pulley

from falling out of the movable rail, the joisted jigs can be reliably positioned at predetermined portions of the frame.

#### 【BRIEF DESCRIPTION OF THE DRAWINGS】

【Fig. 1】 is a schematic perspective view illustrating a temporary welding station for a side member.

【Fig. 2】 is a schematic plan view illustrating a car body assembly line.

【Fig. 3】 is a perspective view illustrating an underbody and the side member.

【Fig. 4】 (A) is a schematic side view illustrating a roller conveyor. (B) is a schematic side view illustrating the roller conveyor with an elevating mechanism at the side member temporary welding station and a roof temporary welding station.

【Fig. 5】 is a schematic perspective view illustrating a coaster for transferring the underbody.

【Fig. 6】 (A) is a plan view illustrating a transfer mechanism for the side member at the side member temporary welding station. (B) is an enlarged section view taken along a line A-A in Fig. 6(A).

【Fig. 7】 is a side view illustrating the side member at the temporary welding station.

【Fig. 8】 is a schematic perspective view illustrating the rear end of a lifter having a locating member for locating a locator provisionally.

【Fig. 9】 is a perspective view illustrating a unified slide base according to a first embodiment.

【Fig. 10】 (A) is a side view illustrating separated slide bases

according to a second embodiment. (B) is a front view of the same.

5     【Fig. 11】 is a schematic perspective view illustrating methods for placing the locator on the slide base and moving toward the car body assembly line, and then locating the side member to the underbody.

      【Fig. 12】 is a schematic plan view illustrating a method for replacing the locators.

10    【Fig. 13】 is a schematic perspective view illustrating a roof pre-setting station.

      【Fig. 14】 is a schematic perspective view illustrating the roof pre-setting station.

      【Fig. 15】 is a schematic side view of the roof pre-setting station.

15    【Fig. 16】 is a schematic front view of the roof pre-setting station.

      【Fig. 17】 is a schematic plan view of the roof pre-setting station.

20    【Fig. 18】 (A) is a schematic front view illustrating a transfer system for joisted jigs used at the roof pre-setting station. (B) is a schematic side view illustrating the positioned joisted jigs.

      【Fig. 19】 (A) is a schematic front view illustrating a swaying prevention mechanism for a movable rail at the roof temporary welding station. (B) is a schematic side section view or the same.

      【Fig. 20】 (A) is a schematic front view illustrating a principal

part of a falling prevention device for pulley at the roof temporary welding station. (B) is a schematic front view illustrating the falling prevention device for pulley of Fig. 20(A), where the pulley is moving.

5    **【Fig. 21】** is a front section view illustrating a locating clamp mechanism for the joisted jigs at the roof temporary welding station.

**【Fig. 22】** (A) is a front view illustrating a replaceable locating mechanism, and (B) is a side view illustrating a fixed  
10   locating mechanism.

**【Legend】**

1	side member temporary welding station2	car
	body assembly line	
3	underbody	
15 4	side member	
5	underbody pre-setting station	
6	roof pre-setting station	
7	roof temporary welding station	
8	roof finally welding station	
20 11	roller conveyor	
14	elevating mechanism (pantograph mechanism)	
15	lifter	
16	locator	
17	slide guide	
25 18	slide base	
22	hole	
24	spacer	

	25	locating pin
	31	roof panel
	34	frame
	35, 36	joisted jig
5	39	clamp arm
	40	front window opening
	41	rear window opening
	42-1, 42-2	mount
	50	transfer machine for joisted jig (transfer
10	hoist)	
	52	elevating mechanism (elevating hoist)
	53	movable rail
	54	fixed rail
	55	space for movable rail
15	56	stopper for defining the upper limit of movable
	rail	
	57	pulley
	58	safety mechanism (stopper)
	60	swaying preventing mechanism for movable rail
20	70	locating mechanism for joisted jig
	80	locating mechanism

【Identification of the Document】

ABSTRACT

【Abstract】 【Object】 To reduce weight and size of jigs for pre-fixing of roof panel to side members, to reduce the business  
5 investment at the beginning, and to facilitate and speed up replacing operation.

【Means】 In a station in a car body assembly line, lower welding ends of side members 4 are welded relative to left and right welding ends of an underbody 3, and in next roof temporary  
10 welding station, an roof panel 31 is temporarily placed between upper welding ends of the side members 4 while left and right welding ends of the roof panel positioned on the upper welding ends of the side members 4. At two front and rear portions of the roof 31, joisted jigs 35, 36 are provided to bridge above  
15 the roof 31, while movably supported at the sides by frame 34 which vertically extend from the floor. The joisted jigs 35, 36 are provided with left and right clamping arms 39 which connect the front and rear portions of the upper welding ends of the side members 4 to the front and rear portions of the  
20 left and right welding ends of the roof panel 31, and the side member 4 is temporarily welded to the roof panel 31 in the positioned manner.

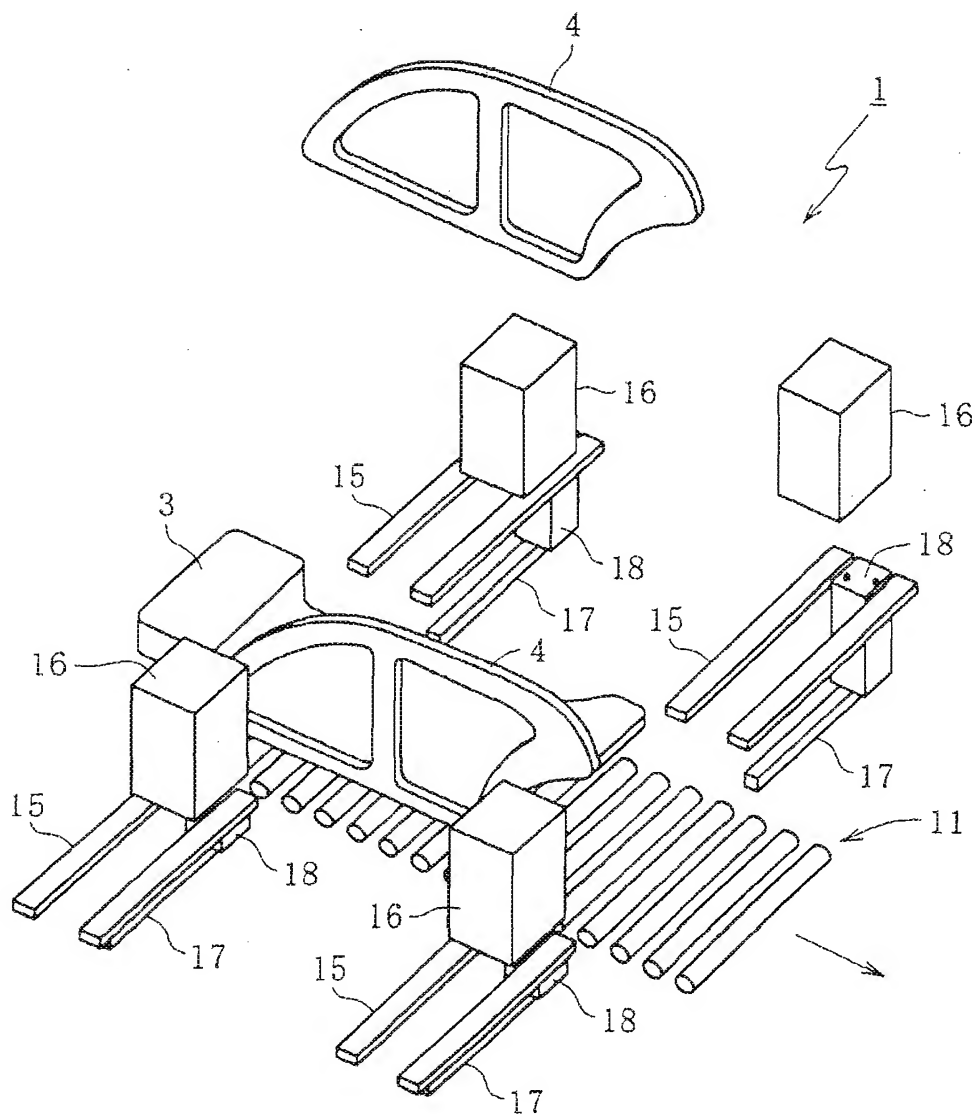
【Selected Figure】

Fig. 14

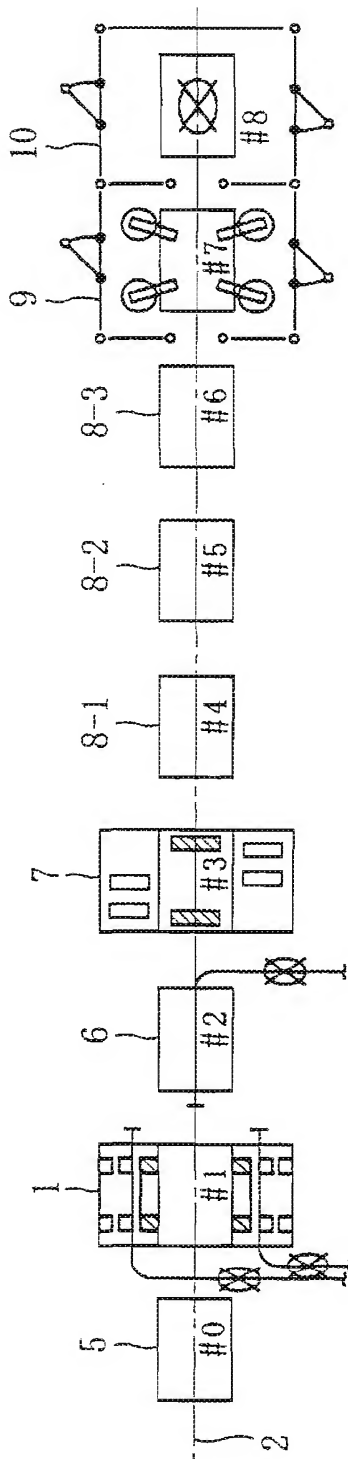
【Identification of Document】

Drawings

【Fig. 1】

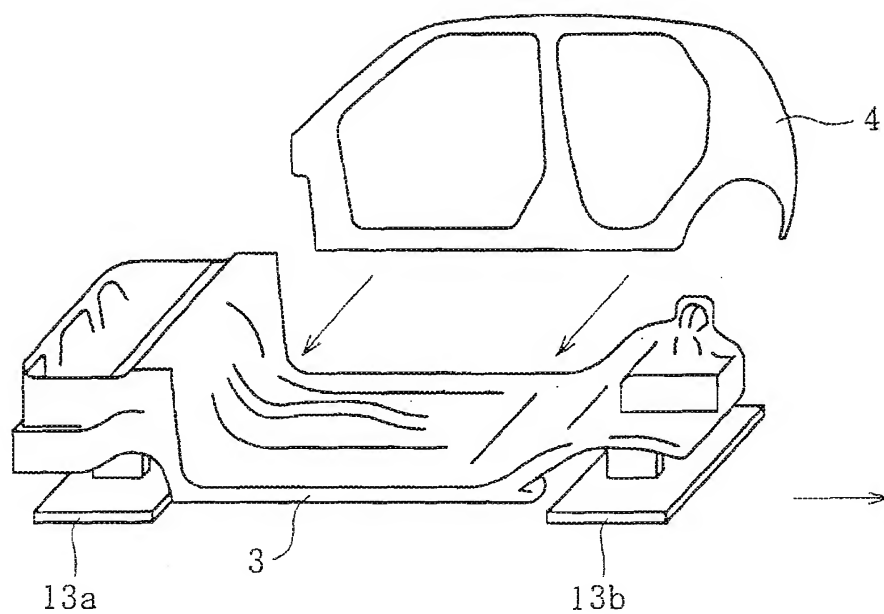


【Fig. 2】

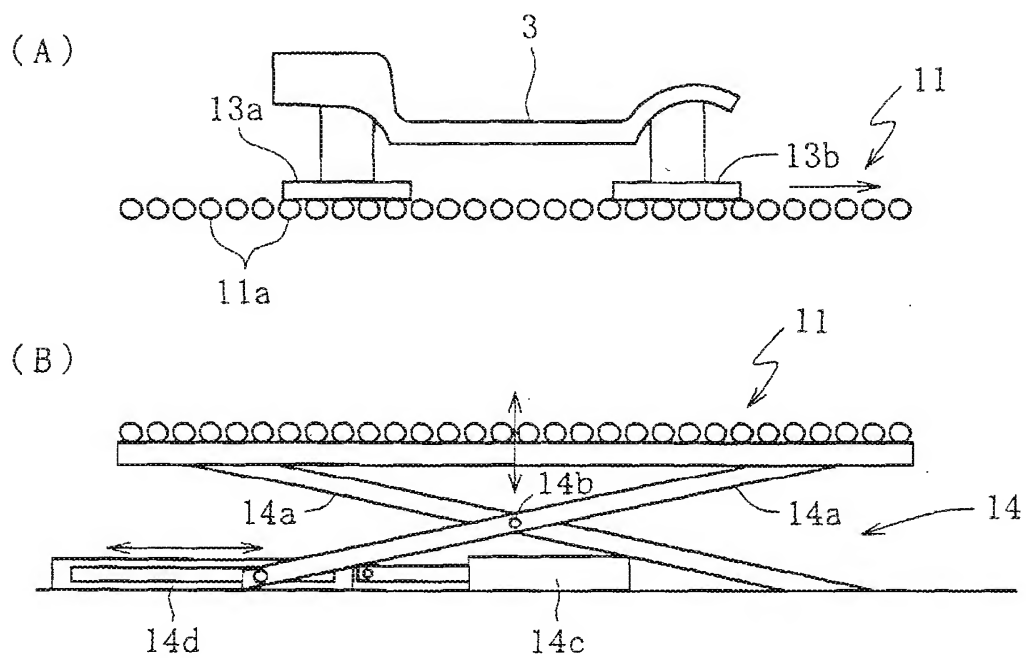




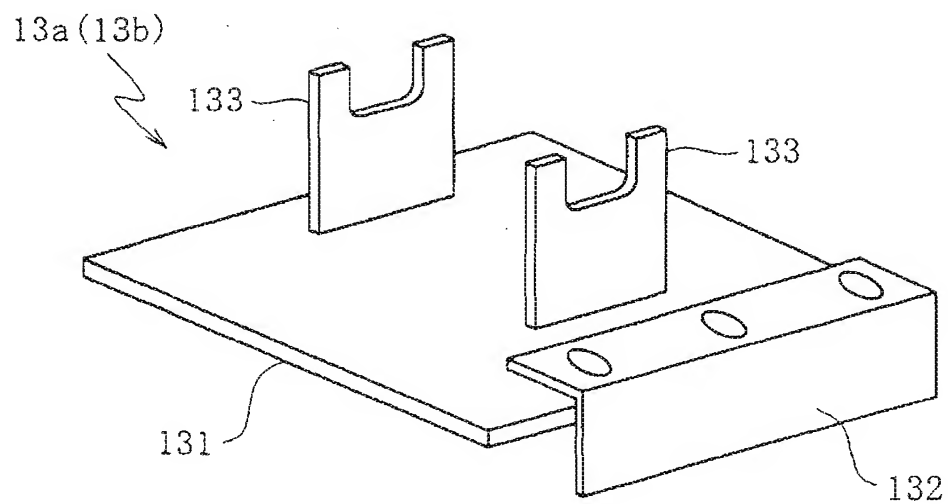
【Fig. 3】



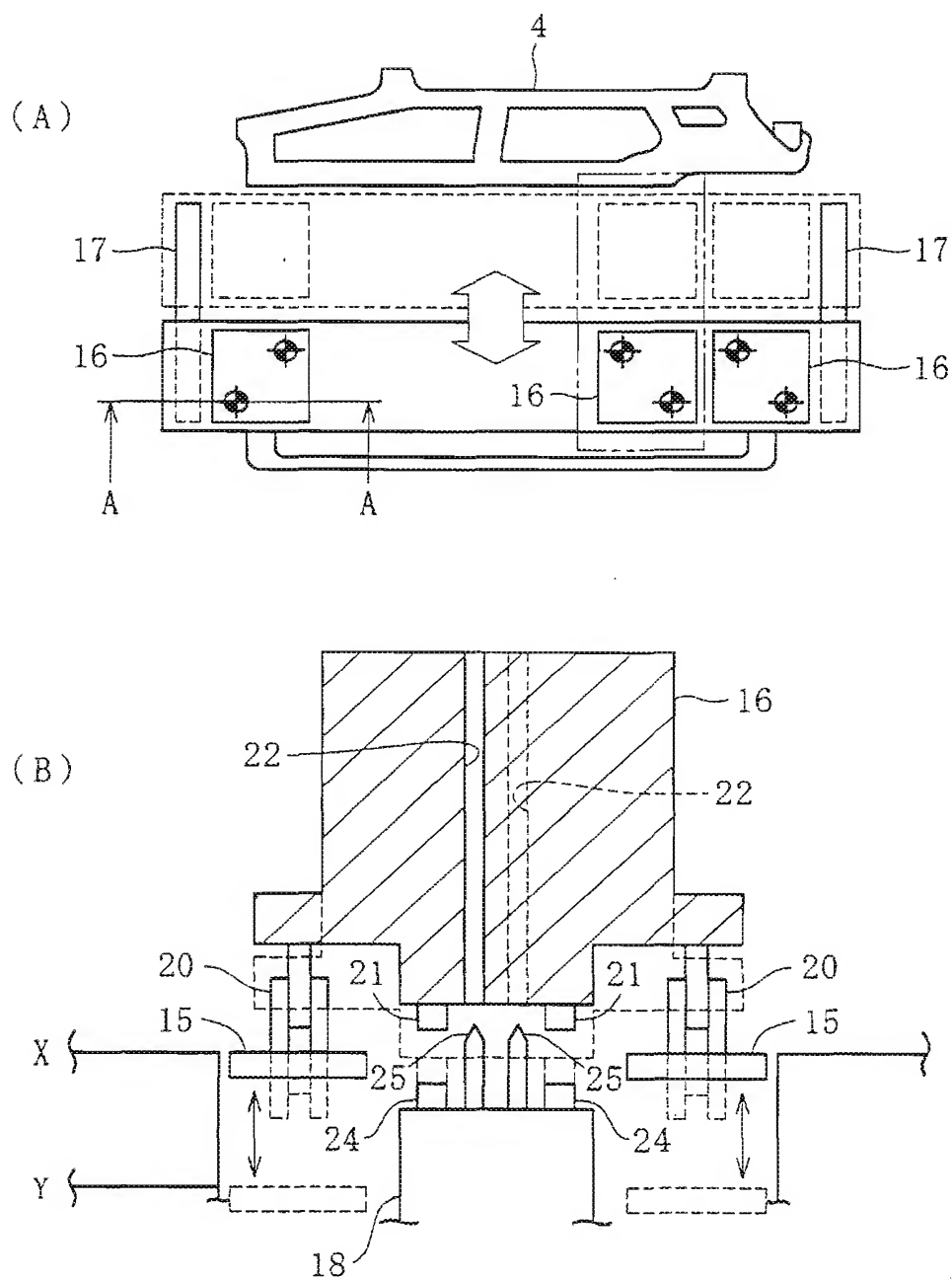
【Fig. 4】



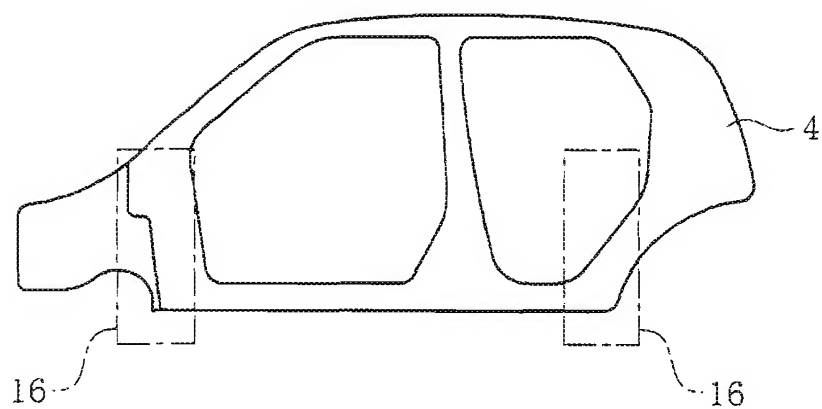
【Fig. 5】



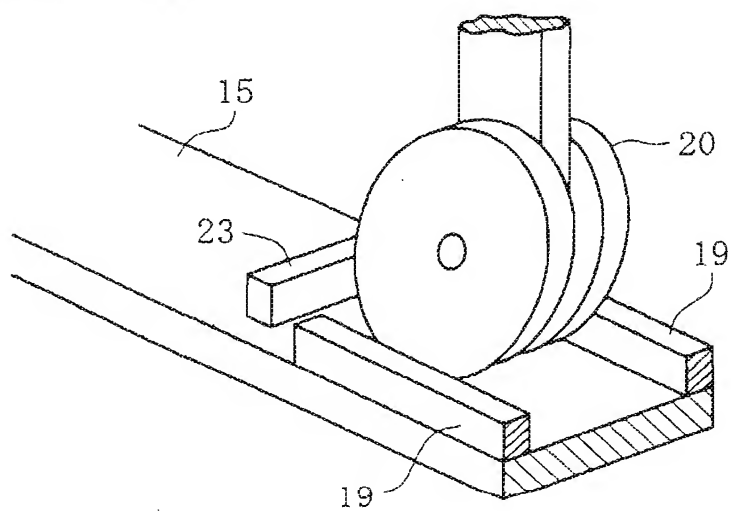
【Fig. 6】



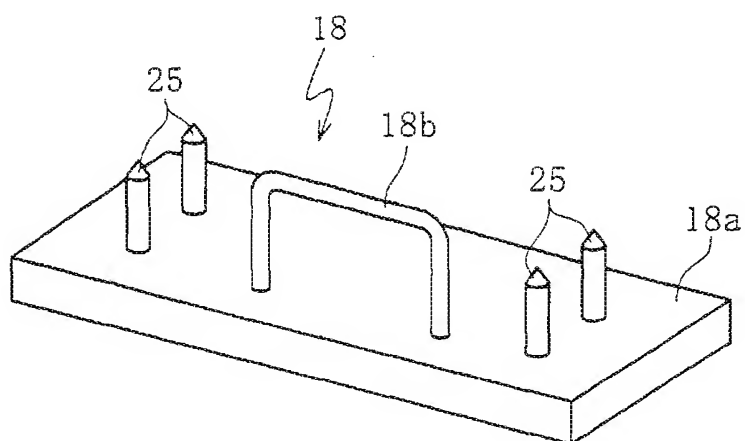
【Fig. 7】



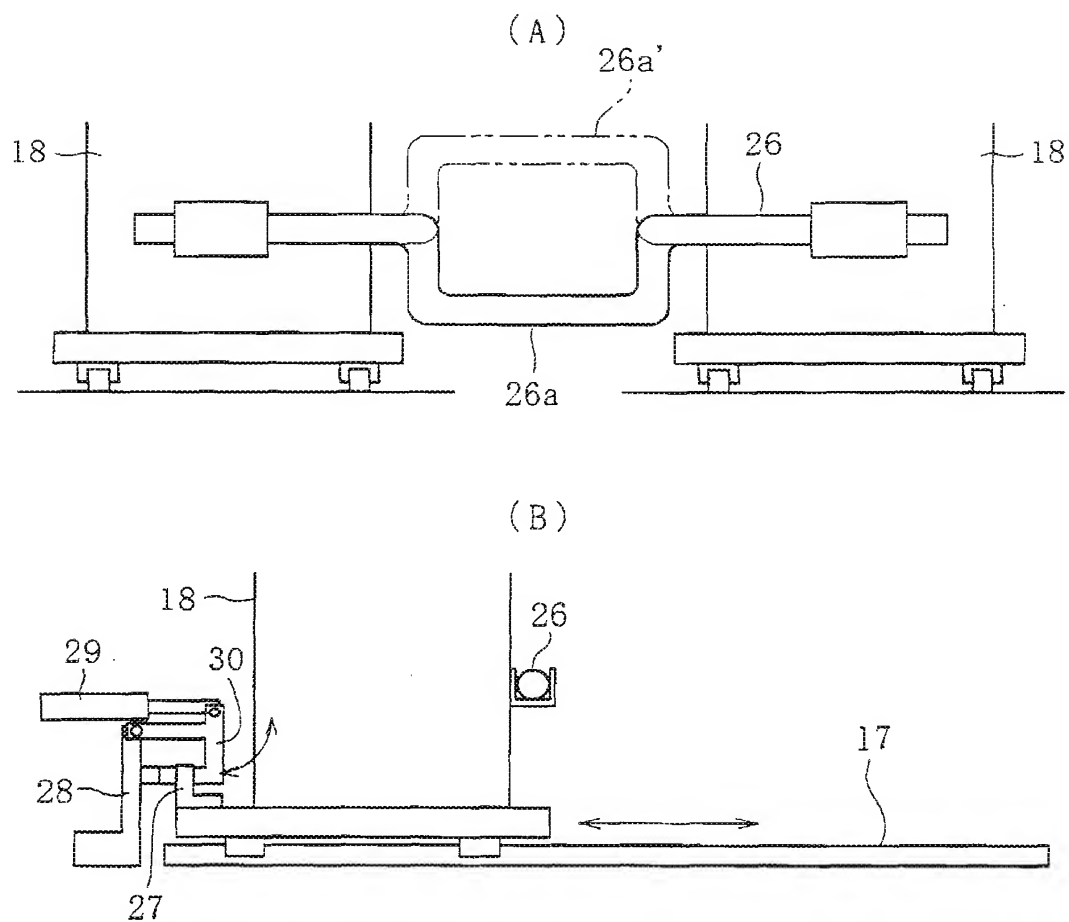
【Fig. 8】



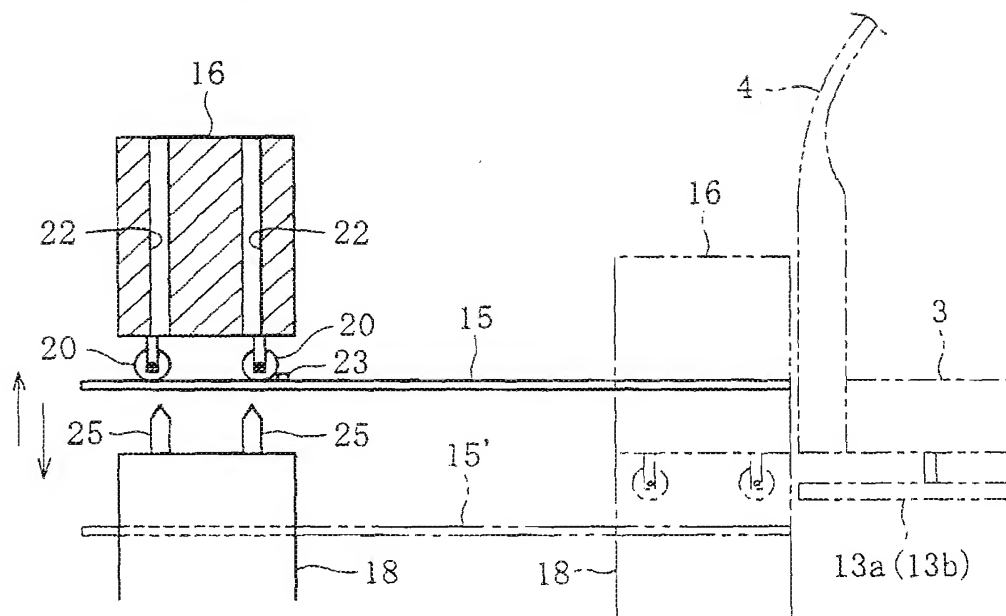
【Fig. 9】



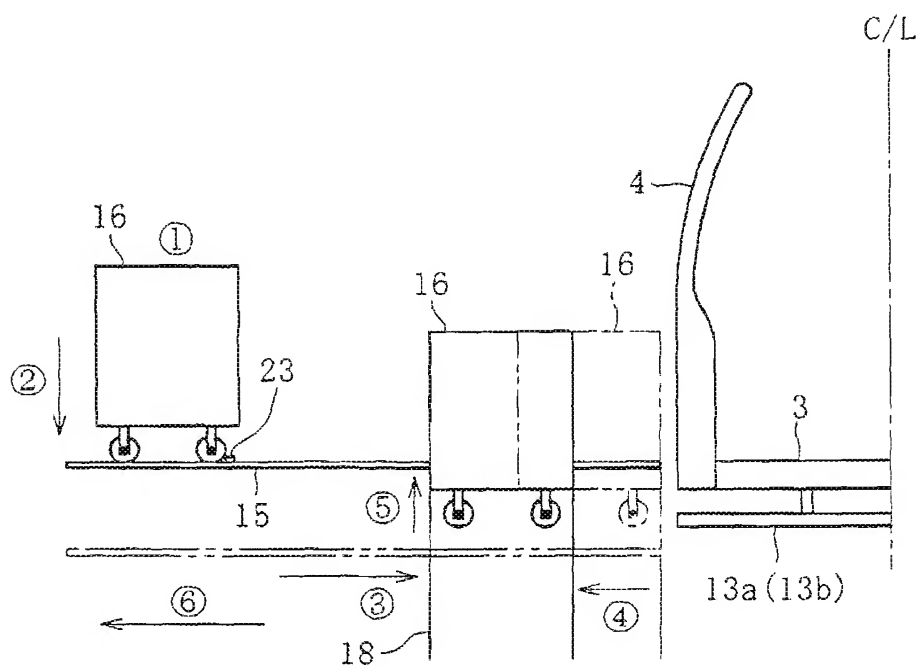
【Fig. 10】



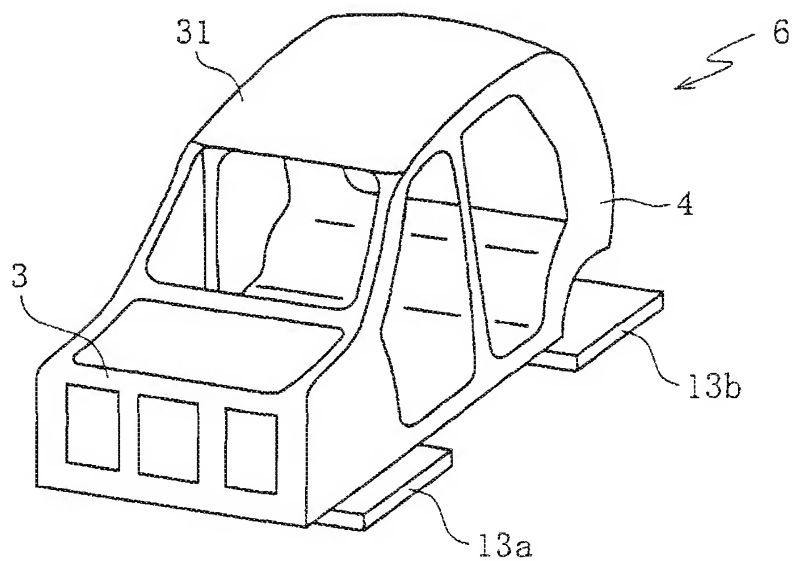
【Fig. 11】



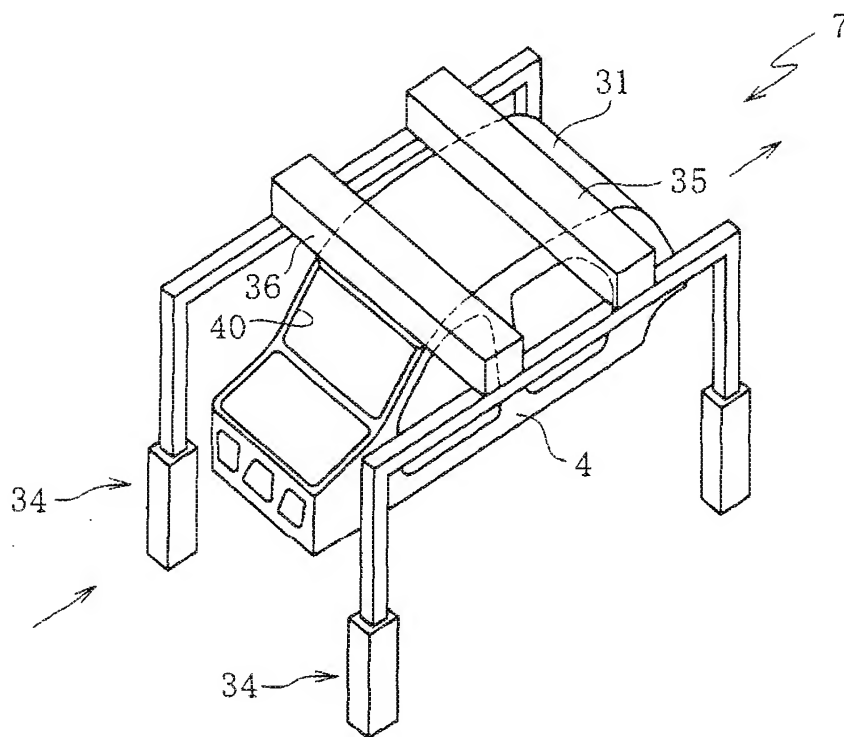
【Fig. 12】



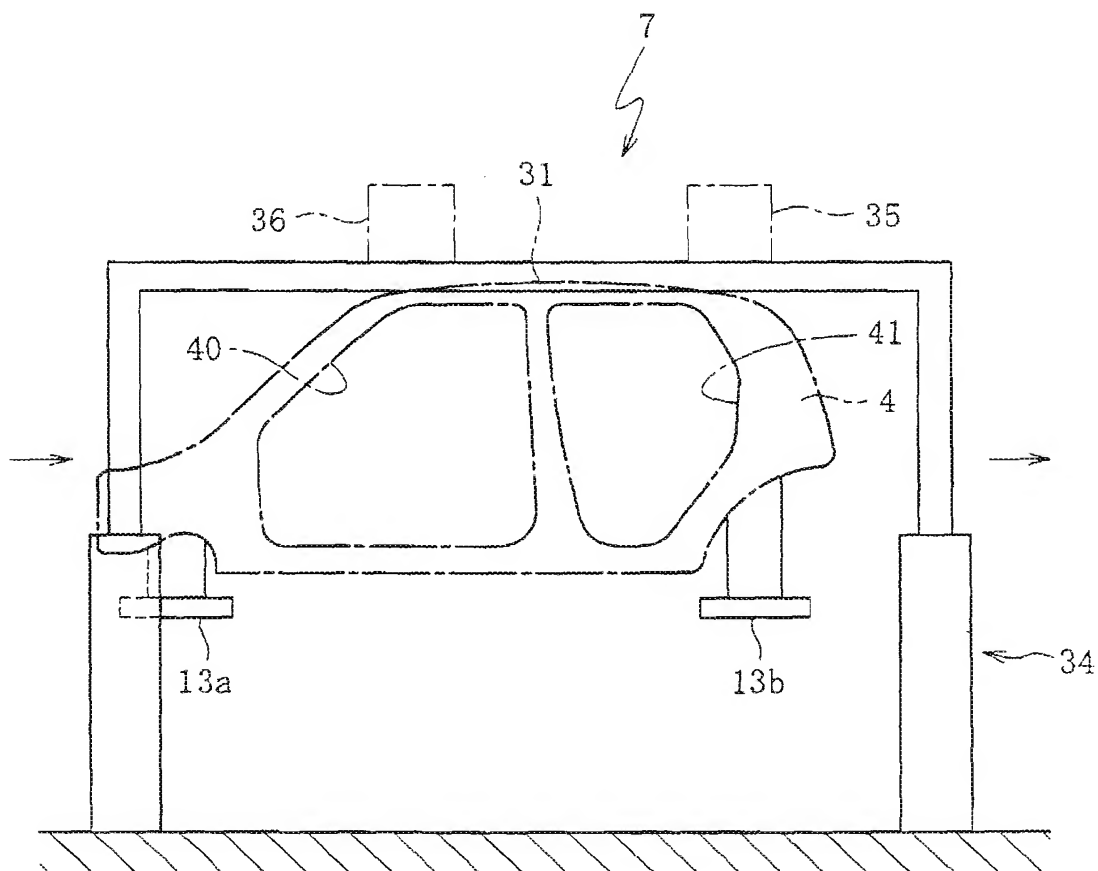
【Fig. 13】



【Fig. 14】

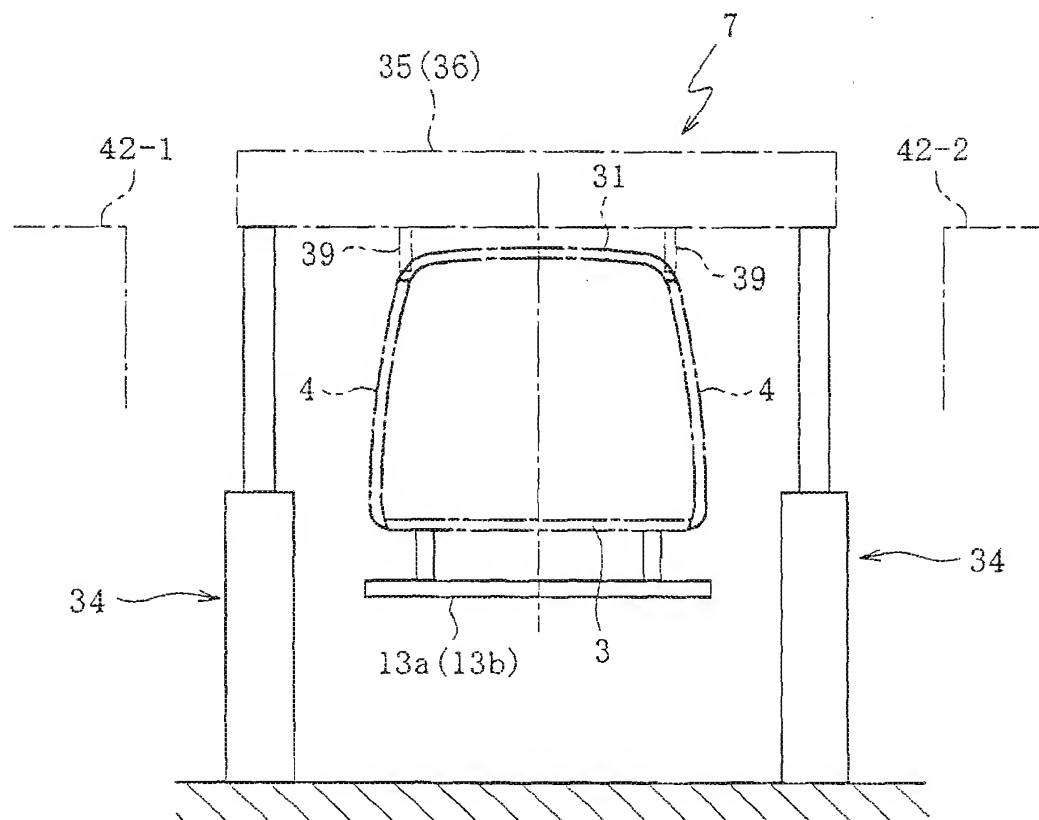


【Fig. 15】

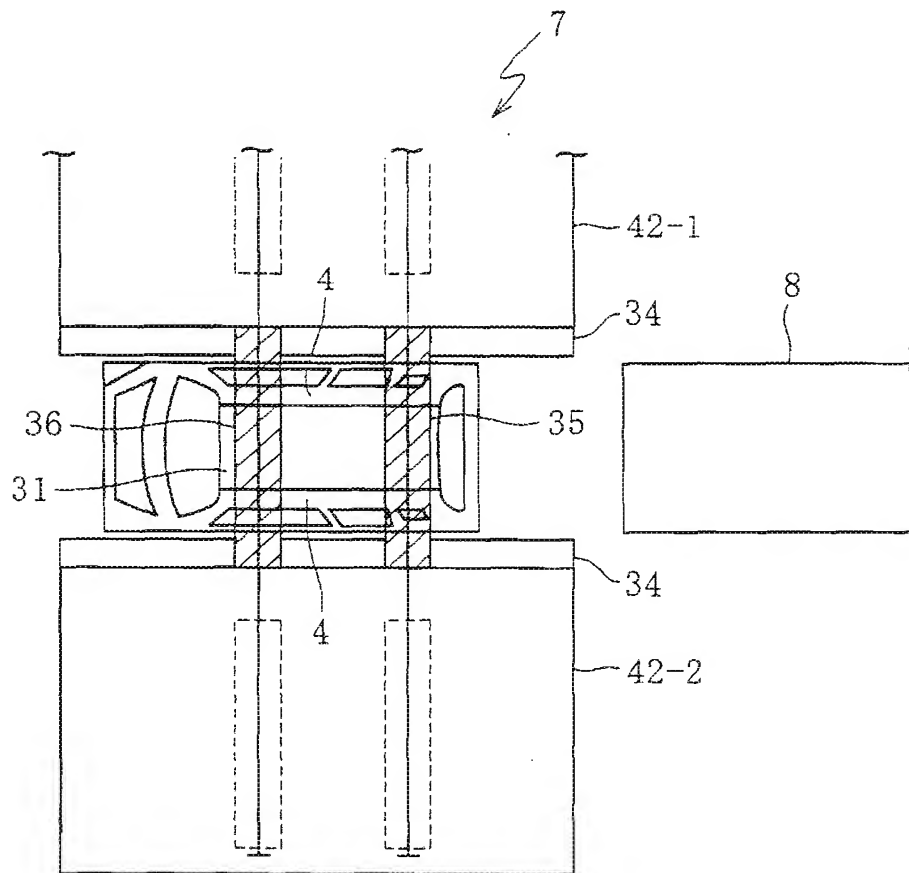




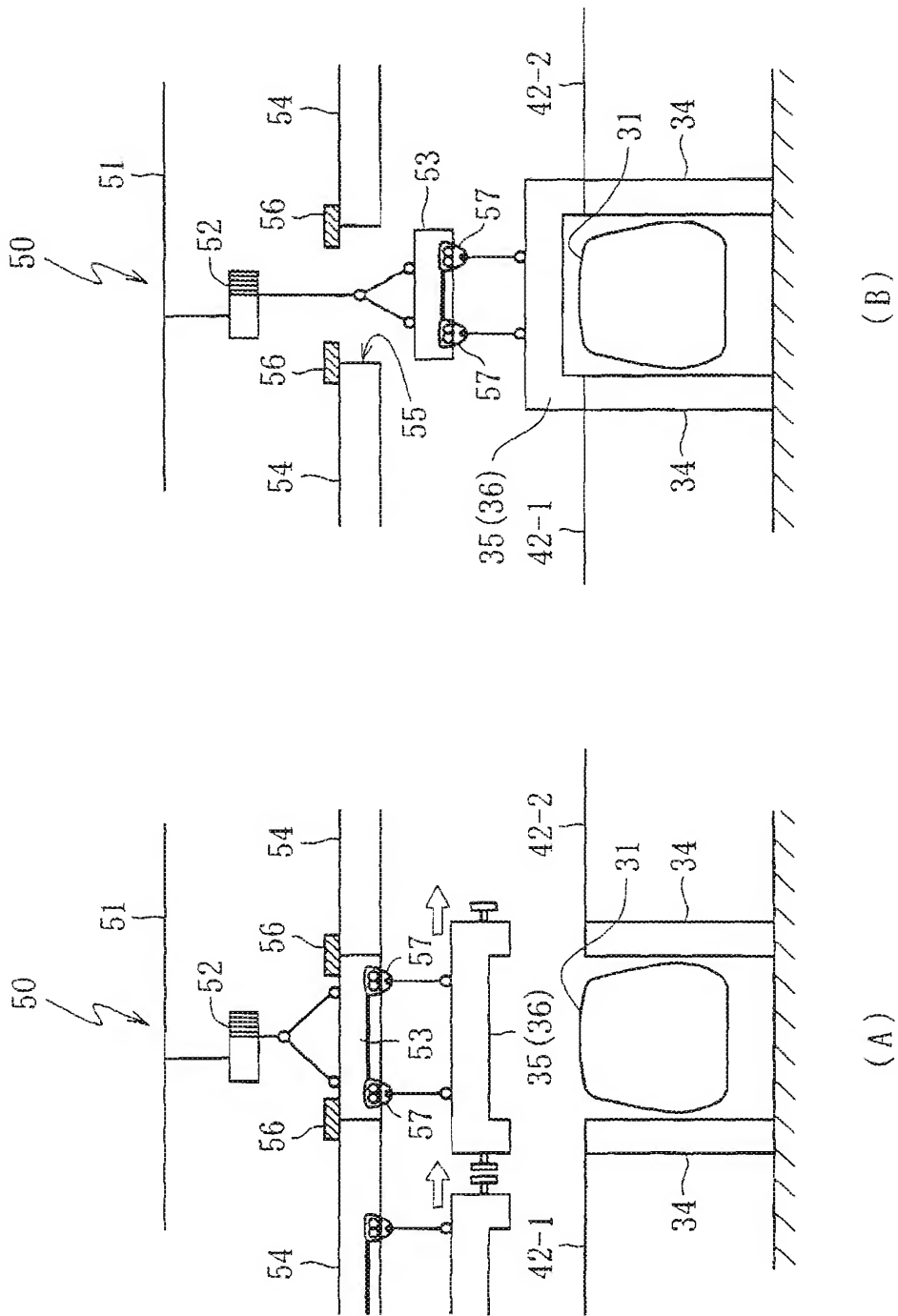
【Fig. 16】



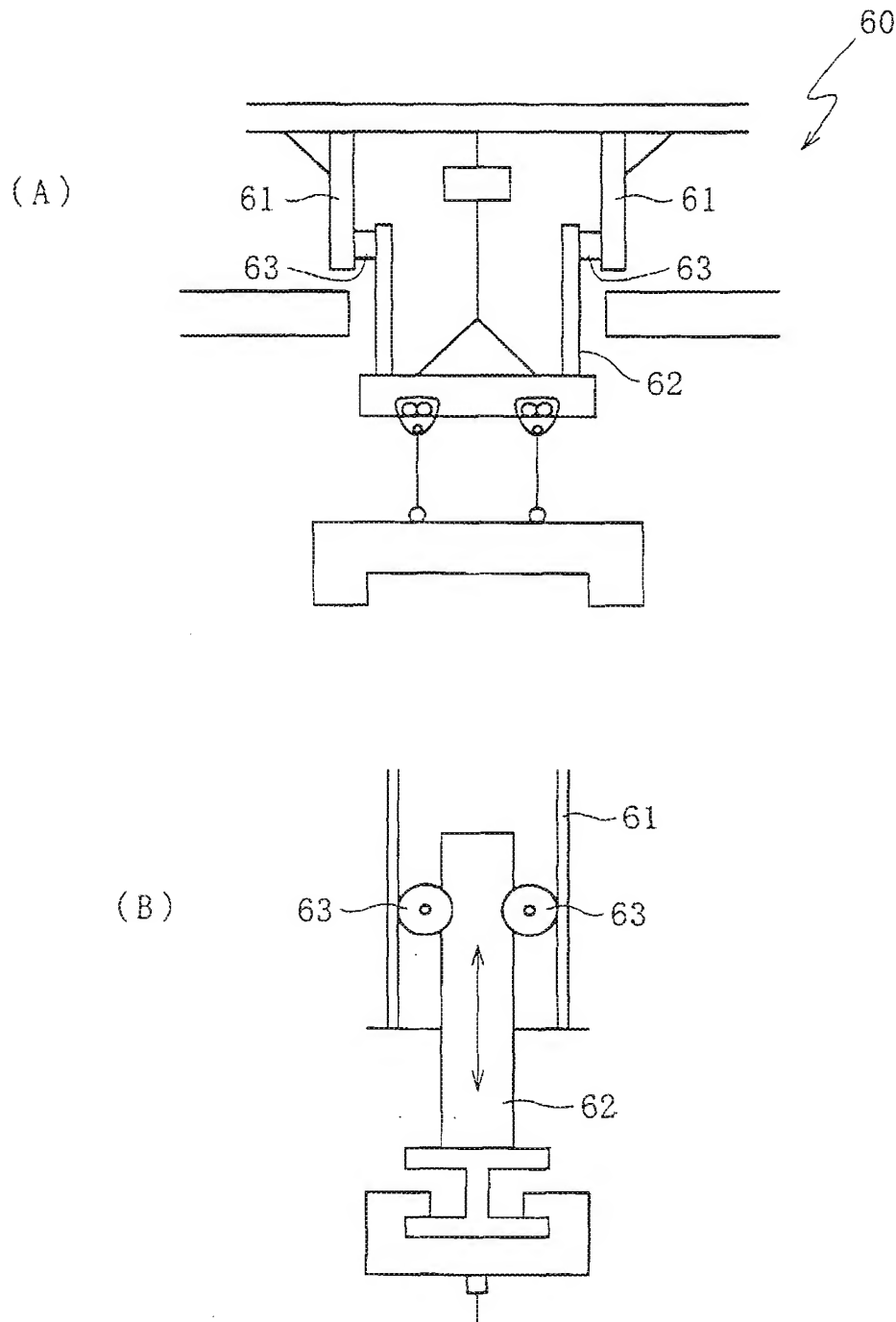
【Fig. 17】



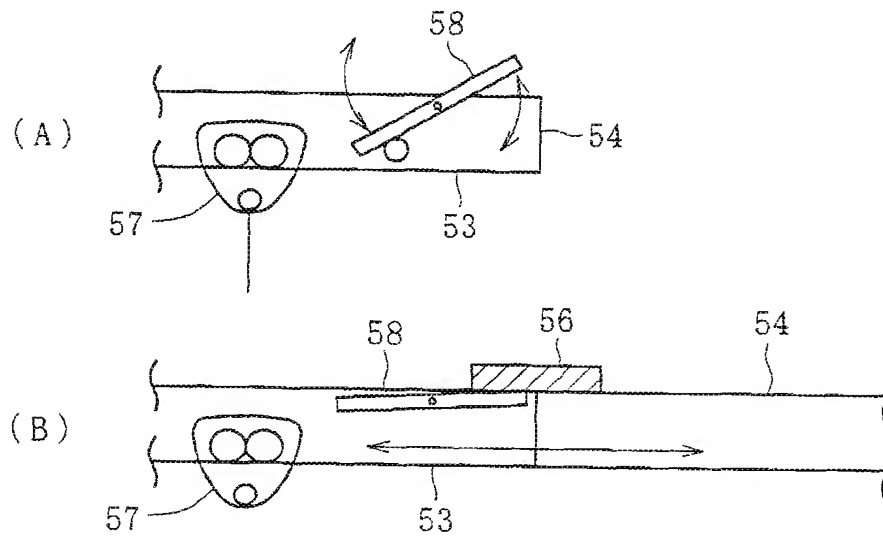
【Fig. 18】



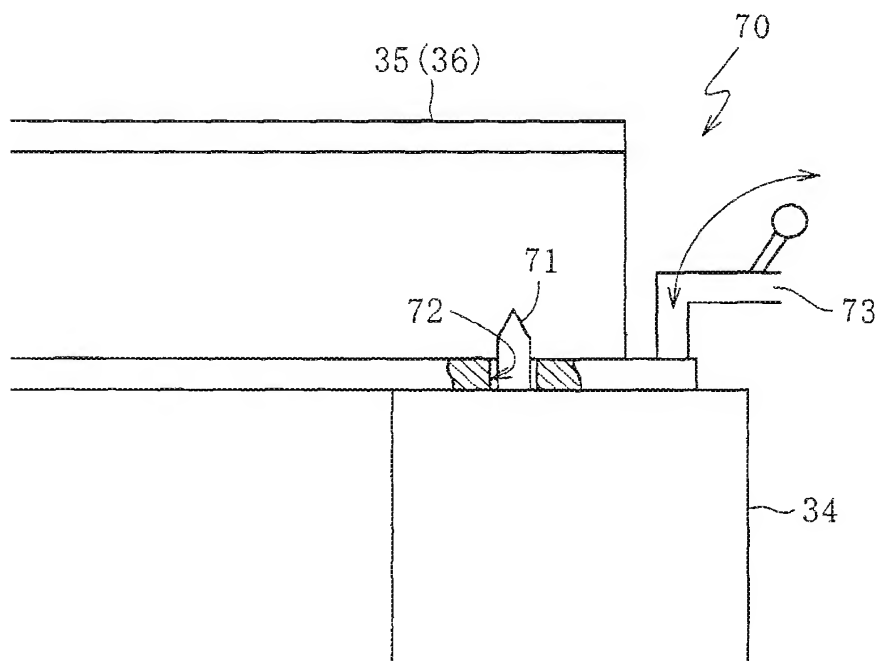
【Fig. 19】



【Fig. 20】



【Fig. 21】



【Fig. 22】

